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HYDRAULIC FLUID STORAGE APPARATUS FOR A TRANSMISSION

TECHNICAL FIELD

[0001] This invention relates to fluid storage apparatus and structure and, more particularly, to fluid storage structures for a power transmission.

5 BACKGROUND OF THE INVENTION

[0002] Power transmissions employ a hydraulic fluid circuit to provide lubrication and hydraulic power to various components within the transmission, such as gears, clutches, brakes, etc. These transmissions therefore need a storage area for the hydraulic fluid that is not in transit 10 during transmission operation.

[0003] The total hydraulic fluid within the transmission is equal to the transmission that is in the transmission sump, the transmission fluid that is currently stored within a component, such a servomechanism for a clutch or brake, and the hydraulic fluid that is in transit between the transmission 15 pump and the sump.

[0004] It is desirable to make the transmission sump volume as small as possible in order to maintain a smaller overall package for the transmission. The volume of the sump oil is required to be large enough to keep the hydraulic pump primed under all conditions and to allow for some expansion 20 for the oil under operating conditions wherein the oil temperature is increased or under elevated speed conditions wherein the volume of fluid that is in transit is decreased. It is desirable that the sump be large enough to prevent the oil level from being operated on by the rotating parts in the transmission. These rotating parts include drums, gears, and shafts, to name 25 a few. The continuous operation of the rotating parts beneath the level of the sump oil reduces the overall efficiency of the transmission as well as causing

foaming within the transmission fluid at elevated speeds. Both of these conditions are undesirable.

- [0005] Prior art transmission structures have employed external reservoirs to store excess fluid and/or thermally controlled reservoirs, which
- 5 provide for fluid storage at elevated temperatures or permit the fluid to return to the basic sump when the temperature decreases, such as when the transmission sits for a long period of time without operation. Both of these additional sump or reservoir systems require valving and control mechanisms so that the main sump is always provided with a minimum amount of oil.

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SUMMARY OF THE INVENTION

- [0006] It is an object of the present invention to provide an improved hydraulic fluid storage system for a power transmission.
- [0007] In one aspect of the present invention, an additional hydraulic storage chamber is disposed above the main transmission sump.
- 15 [0008] In another aspect of the present invention, a fluid passage is provided between the additional storage reservoir and the main storage sump.
- [0009] In yet another aspect of the present invention, at least one rotating component of the power transmission imposes a centrifugal component on the hydraulic fluid in the sump to create a flow restriction between the additional sump and the main sump thereby causing the excess fluid to be stored in the additional sump.
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25 DESCRIPTION OF THE DRAWINGS

- [0010] FIG. 1 is a diagrammatic representation of a portion of a transmission operating under normal fluid level and speed conditions.

[0011] FIG. 2 is a diagrammatic representation of a portion of the transmission shown in FIG. 1 wherein the transmission is operating under increased fluid level and speed conditions.

5 DESCRIPTION OF AN EXEMPLARY EMBODIMENT

[0012] Referring to the drawings, there is seen in FIG. 1 a portion of a power transmission 10 including a housing 12 and a rotating component 14. The rotating component 14 can be any of the rotating mechanisms within a power transmission, such as a clutch drum, a gear mechanism, or a shaft. It
10 is preferable that the rotating component 14 be driven during all transmission operations, for example, an input clutch drum.

[0013] The transmission housing 12 includes a first storage chamber such as a primary or main sump or reservoir 16 and a second storage chamber such as a secondary sump or reservoir 18. The primary sump 16 is in
15 communication with a passage 20 that in turn is connected with a conventional hydraulic pump 22. The hydraulic pump 22 delivers fluid through a passage 24 to a transmission control, not shown. The transmission control, as is well known, will distribute fluid to the operating components of the transmission as well as providing lubrication and cooling flow to the
20 transmission.

[0014] A portion of the fluid that is expelled from operating components and returning from the cooling and lubrication operations is directed through a passage 26. The passage 26 is in fluid communication continuously with the reservoir 18. The reservoir 18 is in communication through a restricted
25 flow passage or opening 28 with the main sump or reservoir 16.

[0015] As the component 14 rotates, hydraulic fluid 30, which is returned to the main sump 16, is acted on by centrifugal force created by the rotating component 14. The rotating component 14 rotates in the direction of Arrow A such that fluid is pumped centrifugally toward the restricted
30 opening 28.

- [0016]** As the speed of the component 14 increases, as seen in FIG. 2, the centrifugal force will create a hydraulic fluid dam 32, which closes the restricted passage 28 resulting in fluid being contained within the reservoir 18. As the volume in reservoir 18 increases, the volume that must be stored 5 in the sump reservoir 16 is decreased. Thus, the fluid level in reservoir 16 is decreased, or maintained at a maximum value by this centrifugal action and reduces the amount of oil that is acted on by the centrifugal forces of the rotating component 14.
- [0017]** The fluid contained within the reservoir 18 might be returning 10 lubrication fluid when the transmission is operating at high speed or it might be a sudden return of fluid from a torque-transmitting mechanism, such as a clutch or brake, when a ratio interchange occurs within the transmission. Under either situation, the fluid is returned within the reservoir 18 until it is required to maintain the level of the reservoir 16.
- [0018]** One such reason for returning the fluid to the reservoir 16 might 15 be a rapid deceleration of the vehicle, where, as speed is reduced, more oil is stored in transit and higher sump levels will be required to keep the hydraulic pump primed. In this case, the centrifugal dam effect will be reduced as speed drops, releasing more of the fluid stored in the reservoir 20 for use in the primary sump. In other conditions, a reduction in operating temperature will also reduce the fluid level within the sump 16 again reducing the centrifugal force created on the hydraulic fluid and allowing the fluid in the sump 18 to return to the sump 14.